CLAIMS

What is claimed is:

1. A method for operating a synchronous space division multiple access, code division multiple access communications system, comprising:

within a coverage area of a base station (BS), assigning the same spreading code to a plurality of subscriber stations (SSs); and

transmitting signals to, and receiving signals from, said SSs using an antenna array having M elements, where $M>1$ and where said M elements are spaced apart by more than one-half wavelength from one another, and where the spacing is a function of a size of an aperture of said antenna array which is a function of a signal bandwidth to carrier frequency ratio.

2. A method for operating a synchronous space division multiple access, code division multiple access communications system, comprising:

within a coverage area of a base station (BS), assigning the same spreading code to a plurality of subscriber stations (SSs); and

conducting communications between said BS and said plurality of SSs by transmitting signals to, and receiving signals from, said SSs using an antenna array having M elements, where $M>1$ and where said M elements are spaced apart by more than one-half wavelength from one another, said spacing being a function of a size of an aperture of said antenna array, where the antenna array aperture is less than $k = p/360 * fc/B$ wavelengths, where p is a maximum acceptable phase variation over the signal bandwidth B, and where fc is the carrier frequency.

3. A method as in claim 2, wherein the step of conducting communications includes steps of despreading a plurality of received signals; and beamforming the plurality of despread received signals.

4. A method as in claim 2, wherein the step of conducting communications includes a step of despreading a plurality of received signals; and spatially filtering the plurality of despread received signals, the step of spatially filtering

using complex multiply operations performed at the symbol rate of the received signal.

5. A method as in claim 2, wherein individual ones of P orthogonal spreading codes are reused αM times within the coverage area, where $1/M<\alpha\leq 1$.

6. A method as in claim 4, wherein the step of spatial filtering comprises steps of operating the subscriber stations to obtain channel estimates comprised of the path amplitude and phase from said antenna elements and sending channel estimates back to the BS as a spatial signature vector, and where the BS, from the spatial signature vectors received from a plurality of same-code subscriber stations, computes antenna element weight vectors.

7. A method as in claim 2, wherein the step of conducting communications includes steps of, for individuals ones of a plurality of same-code subscriber stations, spatially filtering a signal to be transmitted; combining the outputs of a plurality of spatial filters to provide a combined signal to be transmitted; and spreading the combined signal prior to transmitting the combined signal from the antenna array.

8. A method as in claim 2, wherein the carrier frequency is in a range of 2-4 GHz.

9. A method as in claim 2, wherein $M = 16$.

10. A synchronous space division multiple access, code division multiple access communications system, comprising:

a unit for assigning the same spreading code to a plurality of subscriber stations (SSs) within a coverage area of a base station (BS);

a plurality of despreaders for despreading received signals from said plurality of subscriber stations; and

a beamformer coupled to outputs of said plurality of despreaders for beamforming the despread received signals

where the signals are received through. an antenna array having M elements, where $M>1$ and where said M elements are spaced apart by more than one-half wavelength from one another, said spacing being a function of a size of an

aperture of said antenna array which is a function of a signal bandwidth to carrier frequency ratio.

11. A synchronous space division multiple access, code division multiple access communications system, comprising:

a unit for assigning the same spreading code to a plurality of subscriber stations (SSs) within a coverage area of a base station (BS);

a plurality of despreaders for despreading received signals from said plurality of subscriber stations; and

a beamformer coupled to outputs of said plurality of despreaders for beamforming the despread received signals

where the signals are received through. an antenna array having M elements, where $M>1$ and where said M elements are spaced apart by more than one-half wavelength from one another, said spacing being a function of a size of an aperture of said antenna array, where the antenna array aperture is less than $k = p/360 * fc/B$ wavelengths, where p is a maximum acceptable phase variation over the signal bandwidth B, and where fc is the carrier frequency.

12. A system as in claim 11, wherein said beamformer is comprised of a plurality of spatial filters for spatially filtering the despread received signals using complex multiply operations performed at the symbol rate of the received signals.

13. A system as in claim 11, wherein individual ones of P orthogonal spreading codes are reused αM times within the coverage area, where $1/M<\alpha\leq 1$.

14. A system as in claim 11, wherein said subscriber stations operate to obtain channel estimates comprised of the path amplitude and phase from BS antenna elements and to transmit the *m* channel estimates back to the BS as a spatial signature vector, said BS, from the spatial signature vectors received from a plurality of same-code subscriber stations, computing antenna element weight vectors.

15. A system as in claim 11, further comprising a plurality of spatial filters for spatially filtering a signal to be transmitted to individual ones of a plurality of

same-code subscriber stations; a combiner for combining the outputs of the plurality of spatial filters to provide a combined signal to be transmitted; and a spreader for spreading the combined signal prior to transmitting the combined signal from said antenna array.

16. A system as in claim 11, wherein the carrier frequency is in a range of 2-4 GHz.

17. A system as in claim 11, wherein M = 16.